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CLAIMS

[Claim(s)]

[Claim 1] By judging the formation existence of a dot based on image data, and judging the formation existence of a dot for every pixel, diffusing the gradation error produced by this decision in a surrounding non-judged pixel The block means forming which is the image processing system which changes into the image data of the transcription by the formation existence of a dot the image data expressed by the gradation value of each pixel, summarizes the pixel of the predetermined number which adjoined and forms a block, About the view block containing the pixel which is going to judge the formation existence of a dot A processing conditional judgment means to detect the gradation value of each pixel within this view block, and to judge whether this view block fulfills predetermined processing conditions based on the size relation of the this detected gradation value, When said view block satisfies said predetermined processing conditions The 1st image data-conversion means which changes said image data about this view block per block, and when said view block does not satisfy said predetermined processing conditions An image processing system equipped with the 2nd [which constitutes this view block] image data-conversion means which changes said image data for every pixel.

[Claim 2] It is the image processing system which is a means to be an image processing system according to claim 1, and for said processing conditional judgment means to compute the total value of the gradation value about each pixel within said view block, and to judge that said predetermined processing conditions are satisfied when this total value is smaller than a predetermined threshold.

[Claim 3] The gradation value about each pixel within said view block is an image processing system according to claim 2 which is the gradation value which said gradation error diffused.

[Claim 4] This view block is an image processing system which is a means to be an image processing system according to claim 1, and to judge that said predetermined processing conditions are not satisfied when said processing conditional judgment means has the pixel from which the difference of said gradation value between the pixels which adjoin in said view block becomes beyond a predetermined value.

[Claim 5] This view block is an image processing system which is a means to be an image processing system according to claim 1, and to judge that said predetermined processing

conditions are not satisfied when the difference of the gradation value within said view block with said biggest processing conditional-judgment means and the smallest gradation value is beyond a predetermined value.

[Claim 6] It is an image processing system equipped with the 1st error diffusion means which it is [1st] an image processing system according to claim 1, and makes the non-judged pixel of a block which adjoins said view block diffuse the gradation error from which said 1st image data-conversion means produced the dot formation existence about each pixel within said view block in each pixel by this 1st dot formation decision means that judges per view block, and said decision.

[Claim 7] It is the image processing system which is an image processing system according to claim 6, and is a means to judge that said 1st dot formation decision means computes the total value of the gradation value about each pixel within said view block, and forms a dot in the pixel of the predetermined number according to this total value.

[Claim 8] It is the image processing system which is a means to be an image processing system according to claim 7, and to judge that said 1st dot formation decision means forms a dot in the pixel of the predetermined location within said view block according to said total value.

[Claim 9] It is the image processing system which is a means to be an image processing system according to claim 7, and to judge that said 1st dot formation decision means forms a dot in the pixel of said predetermined number in an order from a pixel with a large gradation value within said view block.

[Claim 10] It is the image processing system which is an image processing system according to claim 7, and is a means to judge that said 1st dot formation decision means chooses the location of the pixel which forms a dot within said view block each time, and forms a dot in the pixel of said predetermined number.

[Claim 11] It is the image processing system which is a means to be an image processing system according to claim 7, and to judge that said 1st dot formation decision means does not form a dot in the pixel within this view block when said total value is below a predetermined value.

[Claim 12] It is the image processing system which it has in a diffusion error initialization means is an image processing system according to claim 6, and initialize said gradation error which diffuses in the near block which the view block which this continued when said 1st dot formation decision means is all set to 0 with this view block with which the total which added the gradation value of each pixel within said view block, without taking said gradation error to diffuse into consideration continued follows.

[Claim 13] It is the image processing system which is an image processing system according to claim 6, and said 1st dot formation decision means calculated the total slack error total value of said gradation error diffused in each pixel within said view block, and is equipped with an error total value diffusion means to diffuse this acquired error total value by the predetermined approach in each pixel within this view block.

[Claim 14] It is the image processing system which is a means by which are an image

processing system according to claim 13, and said error total value diffusion means diffuses said error total value by the predetermined ratio in each pixel within said view block.

[Claim 15] It is the image processing system which is an image processing system according to claim 6, and is equipped with a predetermined pixel diffusion means to diffuse said gradation error which diffuses said 1st dot formation decision means in each pixel within said view block in the pixel of the predetermined location within this view block.

[Claim 16] It is the image processing system which is a means to judge the formation existence of the dot about this each pixel while it is an image processing system according to claim 6 and said 1st dot formation decision means makes the non-judged pixel adjoined within this view block diffuse said gradation error produced in each pixel within said view block.

[Claim 17] It is an image processing system according to claim 1. Said 1st image data-conversion means The 2nd dot formation decision means which judges the formation existence of a dot about each pixel within said view block, An image processing system equipped with 2nd error diffusion means by which search for the total slack block error of the gradation error produced in each pixel within said view block, and are in the block which adjoins this view block, and dot formation existence diffuses this acquired block error in a non-judged pixel by said decision.

[Claim 18] It is the image processing system which is a means to ask based on total of the gradation value which is each pixel before it is an image processing system according to claim 17 and said gradation error from the block which adjoins the decision result of the dot formation existence about each pixel within said view block in said block error diffuses said 2nd error diffusion means, and to diffuse this acquired block error.

[Claim 19] It is the image processing system which is a means by which are an image processing system according to claim 17, and said 2nd error diffusion means diffuses said block error by the predetermined ratio in each pixel within the block with which said view block is adjoined.

[Claim 20] It is the image processing system which is a means by which are an image processing system according to claim 19, and said 2nd error diffusion means diffuses said block error in the pixel of the predetermined location within said view block.

[Claim 21] Said block means forming is an image processing system according to claim 1 which is a means to summarize four pixels located in a line with every direction 2 train, and to form said block.

[Claim 22] By judging the formation existence of a dot based on image data, and judging the formation existence of a dot for every pixel, diffusing the gradation error produced by this decision in a surrounding non-judged pixel With outputting these print data to the printing section which changes into the print data of the transcription by the formation existence of a dot the image data expressed by the gradation value of each pixel, forms an ink dot on print media, and prints an image The block means forming which is the print control unit which controls this printing section, summarizes the pixel of the

predetermined number which adjoined and forms a block, About the view block containing the pixel which is going to judge the formation existence of a dot A processing conditional-judgment means to detect the gradation value of each pixel within this view block, and to judge whether this view block fulfills predetermined processing conditions based on the size relation of the this detected gradation value, When said view block satisfies said predetermined processing conditions The 1st image data-conversion means which changes said image data about this view block per block, and when said view block does not satisfy said predetermined processing conditions A print control unit equipped with the 2nd [which constitutes this view block] image data-conversion means which changes said image data for every pixel, and a print-data output means to output said print data obtained with said 1st and 2nd image data-conversion means to said printing section.

[Claim 23] This view block is a print control unit which is a means to be a print control unit according to claim 22, and to judge that said predetermined processing conditions are not satisfied when the difference of the gradation value within said view block with said biggest processing conditional-judgment means and the smallest gradation value is beyond a predetermined value.

[Claim 24] It is a print control unit according to claim 22. Said 1st image data-conversion means The 2nd dot formation decision means which judges the formation existence of a dot about each pixel within said view block, A print control unit equipped with 2nd error diffusion means by which search for the total slack block error of the gradation error produced in each pixel within said view block, and are in the block which adjoins this view block, and dot formation existence diffuses this acquired block error in a non-judged pixel by said decision.

[Claim 25] By judging the formation existence of a dot based on image data, and judging the formation existence of a dot for every pixel, diffusing the gradation error produced by this decision in a surrounding non-judged pixel It is the image-processing approach of changing into the image data of the transcription by the formation existence of a dot the image data expressed by the gradation value of each pixel. About the view block containing the pixel which is going to summarize the pixel of the predetermined number which adjoined, is going to form a block, and is going to judge the formation existence of a dot Detect the gradation value of each pixel within this view block, and it is based on the size relation of the this detected gradation value. When it judges whether this view block fulfills predetermined processing conditions and said view block satisfies said predetermined processing conditions The image-processing approach which constitutes this view block when said image data about this view block is changed per block and said view block does not satisfy said predetermined processing conditions of changing said image data for every pixel.

[Claim 26] It is the image-processing approach that are the image-processing approach according to claim 25, and this view block judges that said predetermined processing conditions are not satisfied on the occasion of decision whether said view block fulfills

predetermined processing conditions when the difference of the biggest gradation value within this view block and the smallest gradation value is beyond a predetermined value. [Claim 27] When it is the image processing approach according to claim 25 and said view block satisfies said predetermined processing conditions About each pixel within said view block, while judging the formation existence of a dot The total slack block error of the gradation error produced in each pixel within this view block by this decision is searched for. The image processing approach of changing said image data per block when it is in the block which adjoins this view block and dot formation existence diffuses this acquired block error in a non-judged pixel.

[Claim 28] By judging the formation existence of a dot based on image data, and judging the formation existence of a dot for every pixel, diffusing the gradation error produced by this decision in a surrounding non-judged pixel The program which realizes the approach of changing into the image data of the transcription by the formation existence of a dot the image data expressed by the gradation value of each pixel The function which summarizes the pixel of the predetermined number which is the record medium recorded possible [reading] and adjoined by computer, and forms a block, The function to detect the gradation value of each pixel within this view block about the view block containing the pixel which is going to judge the formation existence of a dot, When said view block satisfies said predetermined processing conditions with the function to judge whether this view block fulfills predetermined processing conditions, based on the size relation of the detected this gradation value The record medium which recorded the program which realizes the function to change said image data about this view block per block, and the function which constitutes this view block when said view block does not satisfy said predetermined processing conditions to change said image data for every pixel.

[Claim 29] The record medium recorded the program realize the function of judging the dot formation existence about each pixel within said view block per this view block, and the function of making the non-judged pixel of the block which adjoins to said view block diffusing the gradation error which produced in each pixel by said decision, as a function of changing said image data per block about the view block with which it is a record medium according to claim 28, and it is satisfied of said predetermined processing conditions.

[Claim 30] As a function to change said image data per block about the view block with which it is a record medium according to claim 28, and is satisfied of said predetermined processing conditions The function to judge the formation existence of a dot about each pixel within said view block, The record medium recorded the program which realizes the function in which searches for the total slack block error of the gradation error produced in each pixel within said view block, and is in the block which adjoins this view block, and dot formation existence diffuses this acquired block error in a non-judged pixel by said decision.

[Claim 31] By judging the formation existence of a dot based on image data, and judging the formation existence of a dot for every pixel, diffusing the gradation error produced by this decision in a surrounding non-judged pixel The approach of changing into the image data of the transcription by the formation existence of a dot the image data expressed by

the gradation value of each pixel The function which is the program realized using a computer, summarizes the pixel of the predetermined number which adjoined, and forms a block, The function to detect the gradation value of each pixel within this view block about the view block containing the pixel which is going to judge the formation existence of a dot, When said view block satisfies said predetermined processing conditions with the function to judge whether this view block fulfills predetermined processing conditions, based on the size relation of the detected this gradation value The program which realizes the function to change said image data about this view block per block, and the function which constitutes this view block when said view block does not satisfy said predetermined processing conditions to change said image data for every pixel.

[Claim 32] The program realize using a computer the function of judging the dot formation existence about each pixel within said view block per this view block, and the function of making the non-judged pixel of the block adjoin to said view block diffusing the gradation error produced to each pixel by said decision, as a function of changing said image data per block, about the view block with which it is a program according to claim 31, and it is satisfied of said predetermined processing conditions.

[Claim 33] As a function to change said image data per block about the view block with which it is a program according to claim 31, and is satisfied of said predetermined processing conditions The function to judge the formation existence of a dot about each pixel within said view block, The total slack block error of the gradation error produced in each pixel within said view block by said decision is searched for. The program which realizes the function in which is in the block which adjoins this view block, and dot formation existence diffuses this acquired block error in a non-judged pixel using a computer.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the technique of changing image data quickly in detail, with image quality maintained, about the technique changed into the image data expressed by the existence of dot formation of gradation image data.

[0002]

[Description of the Prior Art] The image display device expressing an image is widely used as an output unit of various image devices by forming a dot on print media or a display medium called a liquid crystal screen. Although this image display device cannot express only one condition of whether a dot is formed or not, it is locally possible by controlling the formation consistency of a dot appropriately according to the gradation value of an image for gradation to express the image which changes continuously.

[0003] In these image display devices, as technique for judging the existence of dot formation about each pixel, the technique called an error diffusion method is widely used

so that a dot may be formed by the suitable consistency according to the gradation value of an image. In the error diffusion method's diffusing and memorizing the error of the gradation expression produced having formed the dot in the view pixel, or by having not formed a dot to the non-judged pixel of this view pixel circumference, and judging the existence of the dot formation about a non-judged pixel, it is the technique of judging that dot formation existence cancels the error diffused from the circumference pixel. Thus, since it judges that the formation existence of a dot cancels the error of the gradation expression generated in the circumference pixel, the existence of dot formation can be judged by the suitable consistency according to the gradation value of an image.

[0004] Since a gradation error must be diffused in a circumference pixel whenever it judges the existence of dot formation of what can display a high definition image, since a dot can be formed by the suitable consistency according to an image if this error diffusion method is used, if the number of pixels which constitutes an image increases, it will become difficult for processing to take time amount and to express an image quickly. In order to solve such a problem, the pixel which every [a predetermined number] adjoins is summarized to a block, and the technique of judging the existence of dot formation is proposed, diffusing an error in the block which adjoins from a block (for example, JP,2000-22944,A). Thus, if the existence of dot formation is judged in a block unit, even if the number of pixels which should be processed increases, processing will be completed for a short time, and it will become possible to display an image quickly.

[0005]

[Problem(s) to be Solved by the Invention] However, when such an approach is used, there is a problem of being easy to cause aggravation of the image quality displayed. this judges the existence of dot formation in the block unit which summarized the pixel the predetermined number every -- also taking -- it does not correct, but it is exactly reducing the resolution of an image, but only the part to which resolution falls is considered for image quality to be easy to deteriorate.

[0006] This invention aims at offer of the technique in which an image is quickly convertible for the transcription by the existence of dot formation, maintaining [being made in order to solve the above-mentioned technical problem in the conventional technique, and] image quality.

[0007]

[The means for solving a technical problem, and its operation and effectiveness] The next configuration was used for the image processing system of this invention in order to solve a part of above-mentioned technical problem [at least]. Namely, by judging the formation existence of a dot based on image data, and judging the formation existence of a dot for every pixel, diffusing the gradation error produced by this decision in a surrounding non-judged pixel The block means forming which is the image processing system which changes into the image data of the transcription by the formation existence of a dot the image data expressed by the gradation value of each pixel, summarizes the pixel of the predetermined number which adjoined and forms a block, About the view block containing

the pixel which is going to judge the formation existence of a dot A processing conditional judgment means to detect the gradation value of each pixel within this view block, and to judge whether this view block fulfills predetermined processing conditions based on the size relation of the this detected gradation value, When said view block satisfies said predetermined processing conditions The 1st image data conversion means which changes said image data about this view block per block, and when said view block does not satisfy said predetermined processing conditions Let it be a summary to have the 2nd [which constitutes this view block] image data conversion means which changes said image data for every pixel.

[0008] Moreover, the image processing approach of this invention corresponding to the above-mentioned image processing system By judging the formation existence of a dot based on image data, and judging the formation existence of a dot for every pixel, diffusing the gradation error produced by this decision in a surrounding non-judged pixel It is the image processing approach of changing into the image data of the transcription by the formation existence of a dot the image data expressed by the gradation value of each pixel. About the view block containing the pixel which is going to summarize the pixel of the predetermined number which adjoined, is going to form a block, and is going to judge the formation existence of a dot Detect the gradation value of each pixel within this view block, and it is based on the size relation of the this detected gradation value. When it judges whether this view block fulfills predetermined processing conditions and said view block satisfies said predetermined processing conditions When you change said image data about this view block per block and said view block does not satisfy said predetermined processing conditions, let the thing which constitute this view block and for which said image data is changed for every pixel be a summary.

[0009] In this image processing system and the image processing approach, it faces judging the existence of the dot formation about each pixel which constitutes said view block, and judges whether this view block satisfies predetermined processing conditions based on the size relation of the gradation value which detected and this detected the gradation value of each pixel within this view block. Here, although the gradation value which the gradation error from a circumference pixel diffused is detected as a gradation value of each pixel, the gradation value before a gradation error is spread in simple can also be used. In this way, about the view block judged to satisfy predetermined processing conditions, processing which changes image data into the transcription by the formation existence of a dot is performed per block. If this conversion is performed per block, it will become possible to change only the part quickly. Moreover, about the view block judged not to satisfy predetermined processing conditions, processing which changes image data into the transcription by the formation existence of a dot is performed for every pixel which constitutes this view block. If image data is changed for every pixel, it is avoidable that image quality deteriorates. In this way, if image data is changed by the suitable approach according to whether a view block fulfills predetermined processing conditions, it will become possible to judge dot formation existence quickly, with image quality maintained.

[0010] In this image processing system, the total value of the gradation value about each pixel within said view block is calculated, and when this total value is smaller than a predetermined threshold, you may judge that said predetermined processing conditions are satisfied.

[0011] Since it is thought that the block with which a total value turns into a big value is a block with the big effect on image quality, if it judges that said predetermined processing conditions are satisfied and the formation existence of a dot is judged per block when the total value of a view block is smaller than a predetermined threshold, it will become that it is possible to change image data quickly, without worsening image quality. Moreover, since it becomes possible since said total value about a view block is easily computable to be able to judge simple whether this view block satisfies predetermined processing conditions, as a result to judge the existence of dot formation quickly, if it judges based on this total value, it is suitable. Of course, it is also possible to change into the total value of the gradation value about each pixel within a view block, and to use the average of the gradation value of each pixel.

[0012] In addition, the gradation value which took into consideration the gradation error diffused in each pixel as a gradation value for calculating a total value is used. Usually, since it is carried out based on the gradation value as which the gradation error diffused from the circumference pixel was considered, decision of the formation existence of a dot will become possible [using the conversion approach of image data properly more appropriately], if a total value is calculated from this gradation value. But it is also possible to use the gradation value which the gradation error has not diffused in simple.

[0013] In an above-mentioned image processing system, when there is a pixel from which the difference of said gradation value between the pixels which adjoin in said view block becomes beyond a predetermined value, it is good also as judging that this view block does not fulfill said predetermined processing conditions, and judging the formation existence of a dot for every pixel.

[0014] Or in this image processing system, when the difference of the biggest gradation value within said view block and the smallest gradation value is beyond a predetermined value, it is good also as judging that this view block does not fulfill said predetermined processing conditions, and judging the formation existence of a dot for every pixel.

[0015] In the part which shows the profile part in an image, there is an inclination for the gradation value between pixels to become large. Then, if the formation existence of a dot is judged for every pixel when it judges whether a view block is equivalent to a profile part and corresponds to the profile part by such approach, since image data can be changed appropriately, without reducing the resolution of a profile part, it is suitable. In addition, although the gradation value which the gradation error from a circumference pixel diffused is used as a gradation value used for such decision, the gradation value before a gradation error is spread in simple natural can also be used.

[0016] In the image processing system mentioned above, it is good also as making the non-judged pixel of the block which adjoins said view block diffuse the gradation error

which judged the dot formation existence about each pixel per view block, and was produced in each pixel by decision about said view block with which are satisfied of said predetermined processing conditions.

[0017] In this way, if dot formation existence about a view block is judged per block, it becomes [to judge quickly] possible and is more desirable than the case where formation existence of a dot is judged for every pixel.

[0018] In such an image processing system, when judging dot formation existence per block, the total value of the gradation value about each pixel within said view block is computed, and it is good for the pixel of the predetermined number according to this total value also as judging that a dot is formed.

[0019] If it carries out like this, it will become possible to judge the formation existence of a dot quickly about this view block. And if it sees as this whole view block, since a dot can be formed by the suitable consistency according to the gradation value of each pixel, it is suitable. In addition, although the gradation value which the gradation error from a circumference pixel diffused can be suitably used as gradation of each pixel, it is also possible to use the gradation value before an error is spread in simple.

[0020] Furthermore, in this image processing system, when judging dot formation existence per block, according to said total value, you may judge that a dot is formed in the pixel of the predetermined location within said view block.

[0021] In this way, if the location of the pixel which forms a dot is beforehand defined when forming the dot of a predetermined number in each pixel which constitutes a view block, since processing which forms the dot of a predetermined number within this view block can be performed quickly, it is suitable.

[0022] Or in such an image processing system, when judging dot formation existence per block, you may judge that a dot is formed in the pixel of said predetermined number in an order from a pixel with a large gradation value within said view block.

[0023] In this way, since dot formation existence can be quickly judged about each pixel within forming a dot in descending of a gradation value, then a view block and a dot can moreover be formed in the suitable pixel according to the gradation value of each pixel, it is suitable. In addition, although the gradation value which the gradation error diffused can be suitably used as this gradation value, it is also possible to substitute the gradation value before a gradation error is spread in simple.

[0024] In this image processing system, when judging dot formation existence per block, the location of the pixel which forms a dot within said view block may be chosen each time, and you may judge that a dot is formed in the pixel of said predetermined number.

[0025] If it carries out like this, even when the view block which forms a dot a predetermined number every according to said total value will continue, since there is no possibility that image quality may deteriorate by forming a dot regularly, it is suitable.

[0026] Furthermore, in such an image processing system, when said total value is below a predetermined value, to the pixel within this view block, you may judge that a dot is not formed.

[0027] If it carries out like this, since it becomes possible only by setting up the suitable predetermined value beforehand to judge dot formation existence about a view block quickly, it is desirable.

[0028] In this image processing system, it is good also as judging dot formation existence per block as follows. It asks for total of each gradation value about each pixel within said view block, without taking said gradation error to diffuse into consideration. Subsequently, when each total of this continuous view block is set to 0, said gradation error diffused in the near block which the view block which this continued follows is initialized.

[0029] When total of the gradation value within a view block is continuously set to 0, it is thought that this part is a part in which the image which should be displayed does not exist. Therefore, if the gradation error diffused in the view block of the side which follows is initialized when total of the gradation value within a view block is continuing, since formation fear disappears a dot into the part in which it originates in the diffused gradation error and an image does not exist, it is desirable.

[0030] In the image processing system and the image processing approach of this application which were mentioned above, it is good also as making a judgment of the dot formation existence about said view block per block as follows. That is, it is good also as calculating the total slack error total value of said gradation error diffused in each pixel within this view block, and diffusing this acquired error total value by the predetermined approach in each pixel within this view block.

[0031] In this way, since it becomes possible to be spread more quickly than the case where it is spread according to an individual in each pixel within summarizing the gradation error diffused to each pixel within a view block per block, and diffusing it, then a block, consequently to judge dot formation existence about this view block quickly, it is desirable.

[0032] In this image processing system, it is good also as facing diffusing the gradation error to each pixel within a view block per block, and diffusing said error total value by the predetermined ratio in each pixel within said view block.

[0033] If this error total value defines beforehand the ratio diffused in each pixel within a block, since it can diffuse a diffusion error quickly in each pixel within said view block, only the part becomes [to judge formation existence of a dot quickly] possible and is desirable.

[0034] In such an image processing system, it faces diffusing the gradation error to each pixel within a view block per block, and the gradation error to each [these] pixel shall collect into the pixel of the predetermined location within this view block, and shall be spread.

[0035] If it treats as what the gradation error to each pixel within a view block summarizes to the pixel of the predetermined location within this view block, and diffuses, since it becomes possible to diffuse a gradation error quickly, as a result formation existence of a dot can be judged quickly, it is desirable. In addition, although it can consider as an independent pixel as a pixel which diffuses a gradation error within a view block, it is good also as a thing which makes not only this but two or more pixels diffuse a gradation error by the predetermined ratio.

[0036] Or in the image processing system mentioned above, it is good also as making a judgment of the dot formation existence about said view block per block as follows. That is, it is good also as changing said image data per block by judging the formation existence of the dot about each pixel, making the non-judged pixel adjoined within this view block diffuse said gradation error produced in each pixel within this view block.

[0037] In this way, if the formation existence of a dot is judged diffusing the gradation error produced in each pixel, only the part which diffuses an error can change image data into high definition. Moreover, dot formation existence within a view block can be quickly judged by restricting a gradation error in a block. Since it becomes possible about a view block to change image data quickly after all, without worsening image quality, it is desirable.

[0038] In the image processing system and the image processing approach of this application which were mentioned above, it is good also as making a judgment of the dot formation existence about said view block per block as follows. That is, it is good also as searching for the total slack block error of the gradation error produced in each pixel within this view block by decision of dot formation existence, and diffusing this acquired block error in the non-judged pixel within the block which adjoins this view block.

[0039] In this way, it can be spread more quickly than the case where it is spread according to an individual in each pixel within summarizing the gradation error diffused in each pixel within the block which adjoins a view block per block, and diffusing it, then an adjoining block. Consequently, since it becomes possible to perform quickly processing which changes image data into the transcription by dot formation existence, it is desirable.

[0040] In this image processing system, it is good also as searching for said block error based on the decision result of the dot formation existence about each pixel within said view block, and total of the gradation value which is each pixel before the gradation error from an adjoining block is spread.

[0041] It is possible to search for said block error quickly, since it is not necessary to search for a gradation error for every pixel within said view block, if it carries out like this, as a result since dot formation existence can be judged quickly, it is desirable.

[0042] In this image processing system, it is good also as making it face that an adjoining block diffuses the gradation error produced within the view block per block, and diffusing said block error by the predetermined ratio in each pixel within the block which this adjoins.

[0043] If it carries out like this, since the block error produced with a view block can be quickly diffused in each pixel within an adjoining block, it is desirable.

[0044] Or it is good also as diffusing said block error in the pixel of the predetermined location within an adjoining block.

[0045] In this way, if the pixel location which diffuses a block error is fixed beforehand, since only the part is enabled to be able to make simple processing which diffuses a gradation error and to quicken processing, it is desirable. In addition, although it can also consider as an independent pixel as a pixel of the predetermined location within an

adjoining block, it is good not only for this but two or more pixels also as diffusing a block error by the predetermined ratio.

[0046] Moreover, in the image processing system of this application mentioned above, four pixels located in a line with every direction 2 train are summarized, and it is good also as said block.

[0047] Thus, without worsening image quality as much as possible by judging the existence of dot formation, without diffusing a gradation error between the pixels within this block, if four pixels located in a line with every direction 2 train are summarized and a block is formed, since it can judge quickly, it is suitable.

[0048] Moreover, in the print control unit which controls this printing section, the image processing system of this invention is suitably applicable by outputting the print data for controlling formation of a dot to the printing section which forms an ink dot on print media and prints an image. That is, since it can be quickly changed into the transcription by the existence of dot formation of image data, with image quality maintained, if an above-mentioned image processing system is applied to this print control unit, it becomes [to print a high-definition image quickly] possible and is suitable [the above-mentioned image processing system].

[0049] Moreover, the program which realizes the image-processing approach mentioned above is made to read into a computer, and this invention can also be realized using a computer. Therefore, this invention also contains the mode as following record media. Namely, the record medium of this invention corresponding to the above-mentioned image-processing approach By judging the formation existence of a dot based on image data, and judging the formation existence of a dot for every pixel, diffusing the gradation error produced by this decision in a surrounding non-judged pixel The program which realizes the approach of changing into the image data of the transcription by the formation existence of a dot the image data expressed by the gradation value of each pixel The function which summarizes the pixel of the predetermined number which is the record medium recorded possible [reading] and adjoined by computer, and forms a block, The function to detect the gradation value of each pixel within this view block about the view block containing the pixel which is going to judge the formation existence of a dot, When said view block satisfies said predetermined processing conditions with the function to judge whether this view block fulfills predetermined processing conditions, based on the size relation of the detected this gradation value When said view block does not satisfy said predetermined processing conditions with the function to change said image data about this view block per block Let it be a summary to record the program which realizes the function which constitutes this view block to change said image data for every pixel.

[0050] In such a record medium, it is good also as recording the program which realizes the function judged that this view block does not satisfy said predetermined processing conditions in decision whether said view block fulfills predetermined processing conditions when the difference of the biggest gradation value within this view block and the smallest gradation value is beyond a predetermined value.

[0051] furthermore, as a function to change said image data per block in such a record medium about the view block with which are satisfied of said predetermined processing conditions The program which realizes the function to judge the dot formation existence about each pixel within said view block per this view block, and the function to make the non-judged pixel of the block which adjoins said view block diffuse the gradation error produced in each pixel by said decision may be recorded.

[0052] or as a function to change said image data per block in this record medium about the view block with which are satisfied of said predetermined processing conditions The function to judge the formation existence of a dot about each pixel within said view block, The total slack block error of the gradation error produced in each pixel within said view block by said decision is searched for. The program which realizes the function in which is in the block which adjoins this view block, and dot formation existence diffuses this acquired block error in a non-judged pixel may be recorded.

[0053] If the program currently recorded on these record media is made to read into a computer and various above-mentioned functions are realized using this computer, it will become possible to change into the transcription by the existence of dot formation of image data quickly, with image quality maintained.

[0054] Furthermore, this invention can also grasp various kinds of image-processing approaches mentioned above as a program realized using a computer. Namely, the program of this application corresponding to the above-mentioned image-processing approach By judging the formation existence of a dot based on image data, and judging the formation existence of a dot for every pixel, diffusing the gradation error produced by this decision in a surrounding non-judged pixel The approach of changing into the image data of the transcription by the formation existence of a dot the image data expressed by the gradation value of each pixel The function which is the program realized using a computer, summarizes the pixel of the predetermined number which adjoined, and forms a block, The function to detect the gradation value of each pixel within this view block about the view block containing the pixel which is going to judge the formation existence of a dot, When said view block satisfies said predetermined processing conditions with the function to judge whether this view block fulfills predetermined processing conditions, based on the size relation of the detected this gradation value Let it be a summary to realize the function to change said image data about this view block per block, and the function which constitutes this view block when said view block does not satisfy said predetermined processing conditions to change said image data for every pixel.

[0055] As a function to change said image data per block in the program of such this application about the view block with which are satisfied of said predetermined processing conditions The function to judge the dot formation existence about each pixel within said view block per this view block, It is good also as realizing the function to make the non-judged pixel of the block which adjoins said view block diffuse the gradation error produced in each pixel, using a computer by said decision.

[0056] or as a function to change said image data per block in the program of this

application about the view block with which are satisfied of said predetermined processing conditions The function to judge the formation existence of a dot about each pixel within said view block, The total slack block error of the gradation error produced in each pixel within said view block by said decision is searched for. It is good also as realizing the function in which are in the block which adjoins this view block, and dot formation existence diffuses this acquired block error in a non-judged pixel, using a computer.

[0057]

[Embodiment of the Invention] In order to explain an operation and effectiveness of this invention more clearly, the gestalt of operation of this invention is explained below according to the following sequence.

A. gestalt [of operation] : -- B. equipment-configuration: -- outline [of C. image data-conversion processing] : -- number transform-processing of D. gradation: -- processing [of a D-1. highlights field] : -- D-2. -- processing [of a transitional highlights field] : -- processing [of the field more than D-3. middle gradation] : -- E. modification: -- E-1. 1st modification: -- E-2. 2nd modification: -- E-3. -- 3rd modification: [0058] A. The gestalt of operation : explain the gestalt of operation of this invention, referring to drawing 1 . Drawing 1 is an explanatory view for taking a printing system for an example and explaining the gestalt of operation of this invention. This printing system consists of the computers 10 and color printer 20 grades as an image processing system. A computer 10 will change this image data into the print data expressed by the formation existence of each color dot which can be printed by the color printer 20, if the gradation image data of a RGB color picture is received from image devices, such as a digital camera and a color scanner. Conversion of this image data is performed using the program of the dedication called a printer driver 12. In addition, the gradation image data of a RGB color picture can also be created by computer 10 using various application programs.

[0059] The printer driver 12 consists of two or more modules called the resolution conversion module, the color conversion module, the number conversion module of gradation, and interlace module. Processing which changes gradation image data into the transcription by the existence of dot formation is performed by the number conversion module of gradation. About the processing performed by each of other module, it mentions later. A color printer 20 prints a color picture by forming each color ink dot on print media based on the print data changed by each [these] module.

[0060] Although the number conversion module of gradation in the printing system of this invention summarizes the pixel of a predetermined number to a block and judges the existence of dot formation in a block unit, it has two or more decision modes. Only two typical decision modes are notionally displayed on the number conversion module of gradation of drawing 1 . The decision mode shown in the left-hand side in the number conversion module of gradation of drawing 1 is the mode in which treat a view block like a big pixel and dot formation existence is judged, without distinguishing each pixel within a block. Moreover, the decision mode shown in the right-hand side in the number conversion module of gradation of drawing 1 is the mode in which dot formation existence is judged,

diffusing a gradation error between the pixels within a view block, though processed per block. About each [these] decision mode, it mentions later. In starting processing of a view block, processing conditions are judged, and the existence of dot formation is judged using suitable decision mode. About the detail of the decision approach, it mentions later.

[0061] Thus, the number conversion module of gradation of this invention uses suitable decision mode properly for every block, though it processes per block in order to judge dot formation existence quickly. For this reason, it is possible to perform quick processing, with image quality maintained. Hereafter, such an image-processing approach is explained to a detail based on an example.

[0062] B. Equipment configuration : drawing 2 is the explanatory view showing the configuration of the computer 100 as an image processing system of this example. A computer 100 is a computer of the common knowledge constituted focusing on CPU102 by connecting ROM104, RAM106 of each other, etc. by bus 116.

[0063] The video interface V-I/F112 grade for driving peripheral-device interface P-I/F108 for performing transfer of the disk controller DDC 109, the peripheral device, and data for reading the data of a flexible disk 124 or a compact disk 126 and CRT114 is connected to the computer 100. The color printer 200 mentioned later and the hard disk 118 grade are connected to P-I/F108. Moreover, it is also possible to print a digital camera 120 and the image captured with the digital camera 120 or the color scanner 122 when connecting the color scanner 122 grade to P-I/F108. Moreover, if it equips with Network Interface Card NIC 110, the data memorized by the store 310 which connected the computer 100 to the communication line 300, and was connected to the communication line are also acquirable.

[0064] Drawing 3 is the explanatory view showing the outline configuration of the color printer 200 of the 1st example. A color printer 200 is an ink jet printer which can form the dot of cyanogen, a Magenta, Hierro, and 4 color ink of black. Of course, in addition to the ink of these 4 color, the ink jet printer which can form the ink dot of a total of six colors including cyanogen (light cyanogen) ink with low color concentration and Magenta (light Magenta) ink with low color concentration can also be used. In addition, below, each of cyanogen ink, Magenta ink, Hierro ink, black ink, light cyanogen ink, and light Magenta ink shall be called for short C ink, M ink, Y ink, K ink, LC ink, and LM ink by the case.

[0065] The color printer 200 consists of the device in which drive the print head 241 carried in carriage 240, and the regurgitation of ink and dot formation are performed, a device in which this carriage 240 is made to reciprocate to the shaft orientations of a platen 236 by the carriage motor 230, a device in which a print sheet P is conveyed by the paper feed motor 235, and a control circuit 260 that controls formation of a dot, migration of carriage 240, and conveyance of a print sheet so that it may illustrate.

[0066] Carriage 240 is equipped with the ink cartridge 242 which contains K ink, and the ink cartridge 243 which contains the various ink of C ink, M ink, and Y ink. If carriage 240 is equipped with an ink cartridge 242,243, each ink in a cartridge will be supplied to the head 244 for ink regurgitation for every color prepared in the inferior surface of tongue of a print head 241 thru/or 247 through introductory tubing which is not illustrated. In the

head 244 for ink regurgitation for every color thru/or 247, they are 48 nozzles Nz. The nozzle train arranged in the fixed nozzle pitch k is established 1 set at a time.

[0067] The control circuit 260 consists of CPU261, ROM262, and RAM263 grade, and it carries out the regurgitation of the ink droplet from each nozzle to suitable timing based on the print data supplied from a computer 100 while it controls horizontal scanning and vertical scanning of carriage 240 by controlling actuation of the carriage motor 230 and the paper feed motor 235. In this way, a color printer 200 can print a color picture by forming the ink dot of each color in the suitable location under control of a control circuit 260, and on print media.

[0068] In addition, various approaches are applicable to the approach of carrying out the regurgitation of the ink droplet from the ink discharge head of each color. That is, the method which carries out the regurgitation of the ink using a piezo-electric element, the approach of making generate a bubble (bubble) in an ink path at the heater arranged to the ink path, and carrying out the regurgitation of the ink droplet, etc. can be used. Moreover, it is also possible to use the printer of the method which forms an ink dot on a print sheet using phenomena, such as hot printing, and the method which makes the toner powder of each color adhere on print media using static electricity instead of carrying out the regurgitation of the ink.

[0069] Furthermore, the so-called controllable variable dot impact printer can also be used for the magnitude of the ink dot formed on a print sheet by controlling the magnitude of the ink droplet which carries out the regurgitation, or controlling the number of the ink droplets which breathe out two or more ink droplets at once, and carry out the regurgitation.

[0070] The color printer 200 which has the above hardware configurations moves a print sheet P in the direction of vertical scanning by driving the carriage motor 230 by moving the head 244 for ink regurgitation of each color thru/or 247 to a main scanning direction to a print sheet P, and driving the paper feed motor 235. While a control circuit 260 repeats horizontal scanning and vertical scanning of carriage 240 according to print data, the color printer 200 is printing the color picture on a print sheet by driving a nozzle to suitable timing and carrying out the regurgitation of the ink droplet.

[0071] C. The outline of image data-conversion processing : drawing 4 is a flow chart which shows the flow of the processing which changes image data into print data, when the computer 100 as an image processing system of this example adds a predetermined image processing to the received image data. This processing is started when the operating system of a computer 100 starts a printer driver 12. Hereafter, according to drawing 4 , image data-conversion processing of this example is explained briefly.

[0072] A printer driver 12 will start first reading of the RGB color picture data which should be changed, if image data-conversion processing is started (step S100). Subsequently, the resolution of the incorporated image data is changed into resolution for a color printer 200 to print (step S102). When the resolution of color picture data is lower than print resolution, the resolution of image data is changed into print resolution by

generating new data and thinning out data between the image data which adjoins by performing linear interpolation, at a rate that it is fixed when conversely higher than print resolution.

[0073] In this way, conversion of resolution performs color transform processing of color picture data (step S104). Color transform processing is processing which changes the color picture data currently expressed by the combination of the gradation value of R, G, and B into the image data expressed by the combination of the gradation value of each color used by the color printers 200, such as C, M, Y, and K. Color transform processing can be quickly performed by referring to the table of the three dimension called a color translation table.

[0074] A printer driver 12 starts the number transform processing of gradation following color transform processing (step S106). The number transform processing of gradation is the following processings. RGB image data are changed into the gradation data of C, M, Y, and K each color by color transform processing. The gradation data of each [these] color are data which have 256 gradation of the gradation values 0-255. On the other hand, the color printer 200 of this example cannot take only either condition of "a dot is formed" and "not forming a dot." Then, it is necessary to change the gradation data of each color which has 256 gradation into the image data expressed with 2 gradation which can express a color printer 200. The processing which changes such a number of gradation is the number transform processing of gradation. The printer driver 12 of this example is aiming at coexistence with maintenance of image quality, and high-speed processing by summarizing a pixel to a predetermined number [every] block, and judging dot formation existence by the suitable approach according to the gradation data of each pixel within a block, enabling quick processing by performing the number transform processing of gradation per block so that it may mention later.

[0075] In this way, if the number transform processing of gradation is ended, a printer driver will start interlace processing (step S108). Interlace processing is processing which rearranges the image data changed into the format of expressing the formation existence of a dot into the sequence which should be transmitted to a color printer 200 while taking the formation sequence of a dot into consideration. A printer driver 12 outputs the image data which performed interlace processing and was finally obtained to a color printer 200 as print data (step S110). A color printer 200 forms the ink dot of each color on print media according to print data. Consequently, the color picture corresponding to image data is printed on print media.

[0076] D. The number transform processing of gradation of this example : drawing 5 is a flow chart which shows the flow of the number transform processing of gradation of this example. This processing is performed by CPU102 of a computer 100. In addition, although the color printer 200 of this example is a printer which can form the ink dot of four colors of C, M, Y, and K as mentioned above, and it is also performing the number transform processing of gradation shown in drawing 5 for every color, in order to avoid complicated-ization of explanation, below, it is explained, without specifying a color.

[0077] Initiation of processing sets up the location of a block first (step S200). That is, in the number transform processing of gradation of this example, since the pixel of the adjoining predetermined number is summarized to a block and the dot formation existence of each pixel is judged per block, the location of the view block which is going to judge the formation existence of a dot in an image is set up first.

[0078] Drawing 6 is the explanatory view having shown notionally signs that the location of a view block was set up in an image. Into drawing 6, the small square by which it is indicated by two or more displays a pixel notionally. The image is constituted by two or more pixels arranged in the shape of a grid as shown in drawing 6. The thick broken line surrounding four pixels expresses the view block set up in order to judge the existence of dot formation. In four pixels of explanation which constitutes a block for convenience, the pixel of "Pc" and the lower right shall be called [the pixel of "Pa" and the upper right] "Pd" for the pixel of "Pb" and the lower left, and an upper left pixel shall be distinguished. In addition, although a block is explained below as what consists of four pixels located in a line with every direction 2 train, it is good also as what consists of nine pixels which are not limited to the block of such a configuration, of course, and were located in a line with every direction 3 train, and good also as what consists of two or more pixels located in a line with width 1 train further.

[0079] Although the number transform processing of gradation of this example performs the number transform processing of gradation per view block set up in this way, it judges what kind of field a view block is in an image, and is performing suitable processing by it so that aggravation of image quality may not be caused by this. That is, although mist and lightness are lower than it in whether the high (bright) highlights field of lightness has a view block in an image, it judges whether it is in the transitional field to which it is not a middle gradation field, and whether it is in the field where the lightness more than middle gradation is still lower, and suitable processing is performed according to the field. Below, it explains for every fields of these.

[0080] D-1. Processing of a highlights field : if a view block is set up into an image, the image data of each pixel which constitutes the view block will be read (step S202 of drawing 5). The gradation data of C, M, Y, and K each color which color conversion is carried out and are memorized by RAM106 are read here.

[0081] Subsequently, total of the read image data is computed (step S204). Namely, four pixels Pa which constitute a view block, i.e., a pixel, Pixel Pb, Pixel Pc, and Pixel Pd They are DTa, DTb, DTc, and DTd about a gradation value, respectively. If it carries out $S = DTa + DTb + DTc + DTd \dots (1)$

Total S is computed as be alike. Total S is [the thing which more generally consists of pixels with which the view block was located in a line in the shape of / of an every direction / of n lines / m train / a matrix, then] $S = \sigma (DT_{ij})$

It is computable in be alike. Here, i is the integral value of 1~n, and the integral value of j 1~m.

[0082] In this way, the value of the obtained total S judges whether it is "0" (step S206).

Here, since the gradation value of each pixel cannot take only the value of 0 to 255, only the case where all the gradation values of the pixel from which Total S constitutes a view block are "0" is set to "0." That is, at step S206, it judges whether the view block consists of only pixels of the gradation value 0. When the view block consists of only pixels of the gradation value 0 (step S206: yes), it is judged that a dot is not formed about all the pixels that constitute this view block (step S212).

[0083] When the pixel whose gradation value is not 0 is contained for at least one in the pixel which constitutes a view block (step S206: no), it is the amendment data Bx about a view block. It computes (step S208). Amendment data Bx of a view block The total S computed previously and the diffusion error diffused from the circumference in each pixel which constitutes a view block can be added and searched for. Four pixels Pa which constitute a view block, i.e., a pixel, Pixel Pb, Pixel Pc, and pixel Pd They are EDa, EDb, EDc, and EDd about the diffused diffusion error, respectively. If it carries out, it is the amendment data Bx of a view block. $Bx = S + ETa + ETb + ETc + ETd \dots (2)$

It can ask "Be alike." From a surrounding pixel, it mentions later about how an error is spread. Since the diffusion error diffused in each pixel is memorized by RAM106 for every pixel, it reads these diffusion errors in step S208, and it is the amendment data Bx. It computes. In addition, the diffusion error of each pixel may be read to coincidence, when the gradation value of each pixel is previously read at step S202.

[0084] Subsequently, amendment data Bx for which it asked Predetermined threshold th1 It compares (step S210). And amendment data Bx The direction is a threshold th1. Although the gradation value of all the pixels that constitute a view block is not necessarily "0" when small namely, it is the amendment data Bx. When a value is small, to each pixel of the view block, it is judged as what does not form a dot (step S212).

[0085] It sets to step S210 and is the amendment data Bx. Threshold th1 It is the threshold th2 further predetermined when large. It compares (step S214). Here, it is a threshold th2. Threshold th1 $th1 < th2$ It is set up so that relation may be realized. Amendment data Bx A value is a threshold th2. Case [it is small] th1 (i.e., a threshold) Although it is large, it is a threshold th2. When small (step S214: no), it is judged that a dot is formed only in 1 pixel in the pixel which constitutes a view block (step S216).

[0086] Drawing 7 shows signs that the dot is formed only in 1 pixel in four pixels which constitute a view block. When forming a dot only in 1 pixel under view block, although the formation location of a dot can take four cases so that it may illustrate, it shall always form a dot in the pixel at the upper left of a view block by this example (refer to drawing 7 (a)). If it carries out like this, since processing will be simplified, dot formation existence can be judged so much quickly. Of course, four conditions shown in drawing 7 (a) thru/or drawing 7 (d) may be chosen at random. Or it is good for the biggest pixel of a gradation value also as what forms a dot in the pixel which constitutes a view block.

[0087] In addition, with the number conversion module of gradation of this example, it is the amendment data Bx. When a value is smaller than a threshold th2, a dot is formed only in 1 pixel under block, and in being larger than a threshold th2, while diffusing an

error within a block, it shall judge the existence of dot formation. But threshold th_2 The big threshold th is established and it is the amendment data Bx. A value is a threshold th_2 . Although it is large, when smaller than a threshold th , it is good for 2 pixels of a block also as forming a dot. Although the pixel location which forms a dot can take various combination as an example is shown in drawing 8, it is good also as what may form a dot in the fixed location, or may change at random, and forms a dot in an order from a pixel with a still bigger gradation value.

[0088] Amendment data Bx of a view block A value is a threshold th_2 . When small, it is thought that it is processing also in an image, the high (bright) part, i.e., the highlights field, of lightness, and a dot is formed sparsely. As mentioned above in such a part, it is the amendment data Bx of the whole block. Even if it is based and judges the existence of dot formation, image quality does not deteriorate. Moreover, if the dot is formed sparsely in this way, even if the location in which a dot is formed even if will shift by 1 pixel, there is no possibility that image quality may deteriorate. Therefore, if it does in this way and processing is simplified, it will become possible to judge the existence of dot formation quickly, with image quality maintained.

[0089] D-2. Processing of a transitional highlights field : set to step S214 and it is the amendment data Bx of a view block. Although it is not a highlights field when a value is larger than a threshold th_2 , like a middle gradation field, lightness is considered to process the low (darkly) transitional highlights field which is not. The existence of the dot formation to every pixel is judged making other pixels within a view block diffuse a gradation error, in order to maintain image quality about such a part. Moreover, in order to aim at further improvement in image quality in the number transform processing of gradation of this example, when processing the field more than middle gradation, different processing from a transitional highlights field is performed. Then, it sets to step S214 and is the amendment data Bx. A value is a threshold th_2 . Further predetermined threshold th_3 when it is judged that it is large Size relation is compared (step S218). Here, it is a threshold th_3 . A value is $th_2 < th_3$. It is set as the suitable value of which relation consists. Amendment data Bx of a view block A value is a threshold th_3 . The existence of the dot formation to every pixel is judged, diffusing an error within a view block as follows, since it is thought that a transitional highlights field has a view block when it is judged that it is small (step S220).

[0090] Drawing 9 is the explanatory view having shown notionally how to judge the existence of the dot formation to every pixel within a view block. Four squares shown in drawing 9 (a) show four pixels which constitute a view block. Moreover, drawing 10 is a flow chart which shows the flow of processing. Hereafter, the processing which judges the existence of the dot formation to every pixel is explained, referring to drawing 9 and drawing 10.

[0091] Initiation of the processing which judges dot formation existence reads first the gradation value about a pixel and diffusion error with which it is going to deal (step S300 of drawing 10). The gradation value of a pixel is the image data of each color which color

transform processing is carried out and is memorized by RAM106. Moreover, a diffusion error is an error which is spread from a surrounding pixel and memorized by RAM106. A diffusion error mentions later about how it is spread from a surrounding pixel. Pixel Pa of drawing 9 (a) They are DTa and EDa in the shown square. Being displayed is the gradation value DTa. Diffusion error EDa Pixel Pa What it is matched and is memorized by RAM106 is shown typically. pixel Pa at the upper left of a view block here from -- as what starts processing -- pixel Pa Gradation value DTa Diffusion error EDa It reads.

[0092] Subsequently, it is Pixel Pa by adding the gradation value and diffusion error which were read. Amendment data Cx Amendment data Cx computed and (step S302) computed Size relation with the predetermined threshold th is judged (step S304). amendment data Cx if the direction is large -- pixel Pa **** -- forming a dot -- judging (step S306) -- otherwise, pixel Pa **** -- it is judged that a dot is not formed (step S308). The result of decision is stored in the variable which shows the decision result about each pixel.

[0093] in this way, pixel Pa about -- if dot formation existence is judged, the gradation error produced with decision will be computed (step S310). A gradation error can compute the gradation value (below, this gradation value is called a result value) expressed by that pixel by subtracting from the gradation value of that pixel having formed the dot or by having not formed a dot.

[0094] In this way, the non-judged pixel of the circumference in the same block is made to diffuse the acquired gradation error (step S312). clear, if drawing 9 (a) is referred to -- as -- pixel Pa ***** -- if dot formation existence is judged -- the inside of the same block -- pixel Pb Pixel Pc Pixel Pd Three pixels remain as a non-judged pixel. Then, it sets to step S312 and is Pixel Pa. The produced gradation error is distributed to these three pixels equally [every / 3 / 1], and it adds to the diffusion error memorized by each pixel. for example, pixel Pb **** -- already -- diffusion error EDb since it memorizes on RAM106 -- this value -- pixel Pa from -- the distributed error (1/3 of the gradation error produced in Pixel Pa) -- adding -- new diffusion error EDb ***** -- it memorizes on RAM106. Other Pixels Pc and Pixels Pd Same processing is performed even if it attaches. The above processings are performed at step S312 of drawing 10 . In addition, it is not necessary to necessarily distribute a gradation error to a surrounding non-judged pixel equally, and it may be distributed to each pixel at a predetermined rate. the inside of drawing 9 (a) -- pixel Pa from -- the arrow head currently displayed toward other 3 pixels -- pixel Pa It is shown notionally that the produced error is spread in these three pixels.

[0095] above -- carrying out -- pixel Pa about -- if dot formation existence is judged, it will judge whether decision was ended about all the pixels of a view block (step S314 of drawing 10) and processing of all pixels will not be completed, decision of the dot formation existence about the following new pixel is started.

[0096] pixel Pa about -- if dot formation existence is judged -- a degree -- pixel Pb about -- decision is started. pixel Pb about -- decision -- pixel Pa about -- it can carry out almost like decision. drawing 9 (b) -- pixel Pb about -- it is the explanatory view having shown notionally signs that dot formation existence was judged. Pixel Pa That the slash is given

shows that it is already decision ending about dot formation existence. pixel Pb about -- if decision of dot formation existence is started -- first -- introduction pixel Pb A gradation value and pixel Pb Diffusion error ED_b memorized by being spread reading -- pixel Pb about -- the amendment data C_{xb} are computed. pixel Pb read here Diffusion error ED_b Pixel Pb the diffusion error from the first memorized by matching -- pixel Pa from -- new diffusion error ED_b which added the diffused error and was acquired it is . pixel Pb about -- the amendment data C_{xb} -- gradation value DT_b Diffusion error ED_b It can add and ask. in this way, the thing for which the obtained amendment data C_{xb} are compared with the predetermined threshold th -- pixel Pb about -- dot formation existence is judged and the gradation error produced by decision is computed.

[0097] Pixel Pb obtained as mentioned above The non-judged pixel within a view block is made to diffuse a gradation error. It is shown in drawing 9 (b) and is Pixel Pa like. Since it is already decision ending about dot formation existence if it attaches, it is Pixel Pb. The produced gradation error is Pixel Pc. Pixel Pd It is spread every $[2 / 1]$ in two pixels. Of course, an error may be diffused at a predetermined rate.

[0098] pixel Pb about -- if dot formation existence is judged -- a degree -- pixel Pc about -- decision is started. drawing 9 (c) -- pixel Pc about -- it is the explanatory view having shown notionally signs that dot formation existence was judged. pixel Pc about -- the time of starting dot formation existence -- pixel Pc Diffusion error ED_c memorized by matching **** -- the diffusion error memorized from the first -- in addition, pixel Pa from -- an error and pixel Pb from -- the error is added. pixel Pc about -- diffusion error ED_c to which these errors were added in judging dot formation existence Gradation value DT_c Amendment data are computed by adding and dot formation existence is judged by comparing with the predetermined threshold th. it is shown in drawing 9 (c) -- as -- pixel Pc about -- the non-judged pixel which will remain in a view block if dot formation existence is judged -- pixel Pd only -- it is . then, pixel Pc the produced gradation error -- all -- pixel Pd it is spread -- having -- pixel Pd it adds to the diffusion error memorized from the first -- having -- new diffusion error ED_d ***** -- it memorizes. in this way, diffusion error ED_d of the obtained pixel Pd Pixel Pd Gradation value DT_d computing the amendment data C_{xd} by adding and comparing with a threshold th -- pixel Pd about -- dot formation existence is judged. At step S220 of drawing 5 , dot formation existence is judged for every pixel, diffusing an error within a view block as mentioned above.

[0099] In addition, it faces judging the dot formation existence of each pixel which constitutes a view block from an example shown in drawing 9 , and they are Pixel Pa, Pixel Pb, Pixel Pc, and Pixel Pd. Although judged in sequence, as it is not necessary to necessarily judge in this sequence for example, and is shown in drawing 11 , they are Pixel Pa, Pixel Pc, Pixel Pb, and Pixel Pd. Dot formation existence may be judged in sequence. The case of drawing 9 , and in the case of drawing 11 , if both drawings are compared, the directions which diffuse an error differ within the block and the sequence that good image quality is acquired can be suitably chosen so that clearly.

[0100] If dot formation existence is judged for every pixel within a view block as it

explained above, the error produced with a view block will be calculated (step S222). As mentioned above, when it is judged that a dot was formed in neither of the pixels of a view block (step S212), or also when it is judged that a dot is formed only in 1 pixel (step S216), the error produced with a view block is calculated by having judged such.

[0101] The error produced with a view block is the amendment data Bx of the view block. From a value, it is computable by subtracting the value of a value the result about the block. Amendment data Bx of a view block here It is data which add the diffusion error memorized by Total S and each pixel of the gradation value about each pixel which constitutes a view block, and are obtained. Total S is (1) type and is the amendment data Bx of a view block. It is computed by (2) formulas. Moreover, a value is a total value of a value (gradation value expressed by the pixel that the dot was formed or by not having been formed) the result about each pixel which constitutes the block the result about a view block.

[0102] For example, as a result of each pixel, when forming a dot in neither of the pixels within a view block (in the case of step S212), since all are "0", the value of a value is also "0" as a result of the view block. Therefore, in a view block, the value of the amendment data Bx occurs as an error as it is. Similarly, when a dot is formed only in 1 pixel of a view block, a value turns into a value the result about the pixel in which a dot is formed as a result of a view block (when it is step S216). therefore -- the view block -- amendment data Bx from -- the value which subtracted the value as a result of the pixel in which the dot was formed occurs as an error. When dot formation existence is judged for every pixel within a view block (in the case of step S220), the error produced with a view block can be searched for similarly. But in processing of step S220, since the existence of dot formation is judged making the non-judged pixel within a view block diffuse the gradation error produced in each pixel as explained using drawing 9, the gradation error about the pixel (the example of drawing 9 the pixel Pd) which finally judges dot formation existence, and the error of a view block are in agreement. therefore, pixel Pd about -- by computing a gradation error, the error produced with a view block can also be searched for simple.

[0103] In this way, when computing the error produced with a view block, a circumference pixel is made to diffuse this pixel (step S224). Drawing 12 is the explanatory view having shown notionally signs that a surrounding pixel was made to diffuse the error produced with a view block. The small square shown in drawing 12 displays a pixel typically, respectively. [two or more] Moreover, the big square to which the slash was given shows the view block. Although the block consists of four pixels as a broken line shows in a view block, a surrounding pixel is made to diffuse the error produced with the whole view block which summarized each not a pixel but these pixels. In drawing 12, the black arrow head shows signs that the error of a view block is spread in six surrounding pixels. In the pixel on the left-hand side of a view block, an error is not spread because decision of dot formation existence is completed about these pixels.

[0104] Moreover, as mentioned above, it is the amendment data Bx of a view block. The case (step S212 or step S216 of drawing 5) where dot formation existence is judged simply,

Since each judges the formation existence of a dot per block when judging dot formation existence for every pixel, diffusing an error within a view block (step S220 of drawing 5), in which pixel within a block an error is spread does not pose a big problem. From this, it is shown in drawing 13, and the error produced with a view block may be made like, and may be diffused. That is, since it will be diffused in the same block even if it makes one of pixels diffuse the error diffused in two right-hand side pixels from a view block in drawing 12 as shown in drawing 13 when a highlights field has a view block (in the case of step S212 of drawing 5, or step S216), the decision result of dot formation existence becomes completely the same. Since the formation existence of a dot is judged for every pixel when a transitional highlights field has a view block (in the case of step S220 of drawing 5), when one of pixels is made to diffuse the error which two pixels are made to diffuse, the pixels in which a dot is formed differ. However, since dot formation existence is judged diffusing an error between the pixels within a block even in this case, if it sees as the whole block, the still more nearly same result is obtained and the pixel locations in which a dot is formed only differ slightly within the block. Moreover, since the error diffused in two lower pixels from a view block in drawing 12 will also be diffused, even if it diffuses one of pixels, the almost same result can be obtained. From this, instead of drawing 12, as it is shown in drawing 13, an error may be diffused. The rate of making each pixel diffusing an error can set up a suitable rate beforehand.

[0105] Drawing 14 illustrates an example which set up the rate of making each pixel diffusing an error. The big square which gave the slash expresses a view block with drawing 14, and the small square shown around it displays the pixel which the error from a view block diffuses. [two or more] Moreover, the big square shown with the broken line shows the surrounding block of a view block.

[0106] In the example of drawing 14 (a), the value of the error produced with a view block which is $1/8$, respectively is spread in two pixels in the right-hand side of a view block. An error is spread every $[8/1]$ also like two pixels with the view block bottom. Moreover, in the pixel at the lower left of a view block, or a lower right pixel, an error is spread every $[4/1]$, respectively. Thus, if an error is diffused, an error will be equally spread every $[4/1]$ in the surrounding block of a view block, respectively. Of course, the error diffused in the same block is summarized to one pixel, and you may make it diffuse it. For example, as shown in drawing 14 (b), even if it diffuses an error, a result almost equivalent to the case of drawing 14 (a) can be obtained. Thus, if the error diffused in the same block will be diffused collectively, since the number of pixels which should diffuse an error can be reduced, processing can be quickened so much.

[0107] In the example shown in drawing 14 (c), the rates of the error diffused in each block differ. It is between blocks and the rate which diffuses an error may be changed so that good image quality may be acquired. Moreover, the error is spread in the pixel which is blocking in the block at the lower left of a view block, and judges dot formation existence first to it. Thus, an error may be diffused in the pixel which does not necessarily adjoin a view block.

[0108] Of course, an error may be diffused in the large range including the block which shows drawing 14 (d) and does not adjoin a view block like. Furthermore, as shown in drawing 14 (e), an error may be diffused per block. That is, the pixel within this block may be made to diffuse equally the error which diffused the error in the surrounding block from the view block, and was diffused in each block.

[0109] In step S224 of drawing 5 , as explained above, processing which makes a surrounding pixel diffuse the error produced with the whole view block at a predetermined rate is performed.

[0110] D-3. Processing of the field more than middle gradation : set to step S218 and it is the amendment data Bx of a view block. When a value is larger than a threshold th3, it is thought that the view block is set as the field more than the middle gradation in an image. In such a field, though dot formation existence is judged per block, the existence of dot formation is judged, diffusing the error produced in each pixel like the so-called error diffusion method (step S226). For this reason, in the number transform processing of gradation of this example, image quality is maintainable also in the field beyond the middle gradation value in an image.

[0111] Drawing 15 is the explanatory view having shown notionally the processing which judges dot formation existence for every pixel in step S226, diffusing the error of each pixel. The square which the big square shown with the broken line in drawing 15 showed the view block, and was shown as the continuous line during the view block shows the pixel. The pixel besides a view block is expressed as the square of a broken line. Each pixel within a view block is [pixel / upper left / pixel / Pixel Pa and / upper right] Pixel Pd about Pixel Pc and a lower right pixel in Pixel Pb and a lower left pixel. It calls and each pixel is identified. Moreover, Pixel Pa, Pixel Pb, Pixel Pc, and Pixel Pd DTa currently displayed inside, DTb, DTc, and DTd The gradation value of each pixel is shown and they are EDa, EDb, EDc, and EDd. The diffusion error memorized by being spread in each pixel is shown.

[0112] In step S226, the processing which judges dot formation existence for every pixel while diffusing the error of each pixel is the same as the processing (processing of step S220) previously explained using drawing 9 and drawing 10 almost. By processing of step S220 mentioned above, it differs greatly in that the pixel besides a view block is made to diffuse an error by processing of step S226 in which the error produced in each pixel is explained below to having been spread in the pixel within a view block. Thus, since dot formation existence is judged also making the pixel besides a view block diffuse the error produced in each pixel, processing almost equivalent to the technique called the so-called error diffusion method can be performed. Consequently, it is possible also in the field more than the middle gradation in an image to judge dot formation existence, without worsening image quality. Below, referring to drawing 15 , the flow chart shown in drawing 10 is diverted, and the processing performed at step S226 of drawing 5 is explained.

[0113] Pixel Pa which is in the upper left of a view block first also in processing of step S226 like the processing performed at step S220 when processing is started Gradation value DTa And diffusion error EDa It reads (about [of drawing 10 / step S300]). The

gradation value and diffusion error of each pixel are matched with each pixel, and are memorized on RAM106.

[0114] Subsequently, it is Pixel Pa by adding the gradation value and diffusion error which were read. Amendment data Cx Amendment data Cx computed and (about [of drawing 10 / step S302]) computed Size relation with the predetermined threshold th is judged (about [of drawing 10 / step S304]). and amendment data Cx if the direction is large -- pixel Pa **** -- forming a dot -- judging (about [of drawing 10 / step S306]) -- otherwise, pixel Pa **** -- it is judged that a dot is not formed (about [of drawing 10 / step S308]). The result of decision is stored in the variable which shows the decision result about each pixel.

[0115] in this way, pixel Pa about -- when judging dot formation existence, the gradation error produced with decision is computed (about [of drawing 10 / step S310]), predetermined appears in a surrounding non-judged pixel comparatively, and it is made to diffuse the acquired gradation error (about [of drawing 10 / step S312]) Here, in processing of step S226 of drawing 5, the rate of making a circumference pixel diffusing an error is beforehand defined according to in which location for the pixel which the gradation error produced to view block and to be. Drawing 16 is the explanatory view which illustrated an example to which the rate of making a circumference pixel diffusing an error is set according to the location which is the pixel which the gradation error produced. Drawing 16 (a) is the pixel Pa at the upper left of a view block, i.e., a pixel. The rate of making a circumference pixel diffusing the produced gradation error is shown. Being indicated as "" all over drawing shows the location which is the pixel which the gradation error generated. pixel Pa the produced gradation error -- pixel Pb And pixel Pc it is spread every [8 / 3], respectively -- having -- pixel Pd **** -- one fourth of gradation errors is spread. Of course, the rate to diffuse is not limited to this rate and can be set as various rates according to the property of the image to process.

[0116] Drawing 15 (a) is Pixel Pa. It is the explanatory view having shown notionally signs that the surrounding non-judged pixel was made to diffuse the produced gradation error. The slash given to the pixel shows that a judgment of dot formation existence is already made. The pixel of the left of Pixel Pa is already decision ending about dot formation existence as illustrated. Moreover, since dot formation existence is judged sequentially from the block which is in an upper case like the usual number transform processing of gradation, the number transform processing of gradation of this example is Pixel Pa. It is already decision ending about dot formation existence also about an upper pixel. This to pixel Pa A surrounding non-judged pixel is other three pixels Pb in a view block, i.e., a pixel, Pixel Pc, and Pixel Pd. It becomes and is Pixel Pa. The produced gradation error is diffused in these three pixels.

[0117] the rate which an error diffuses in each pixel as an example is a rate shown in drawing 16 (a) -- then, pixel Pb **** -- pixel Pa three eighths of the values of the produced gradation error are spread -- having -- pixel Pb Diffusion error EDb memorized by matching it adds -- having -- pixel Pb New diffusion error EDb ***** -- it memorizes. pixel Pc ***** -- the same -- diffusion error EDC a value -- pixel Pa three eighths of the values

of the produced gradation error add -- having -- pixel Pc New diffusion error EDc ***** -- it memorizes. moreover, pixel Pd ***** -- pixel Pa one fourth of the values of the produced gradation error add -- having -- pixel Pd New diffusion error EDd ***** -- it memorizes. drawing 15 (a) -- setting -- pixel Pa from -- the arrow head of the void which goes to other three pixels -- such -- pixel Pa It means typically that the produced gradation error is spread in other three pixels.

[0118] in this way, pixel Pa about -- dot formation existence -- judging -- pixel Pa If the produced gradation error is diffused in a surrounding non-judged pixel, it will judge whether decision was ended about all the pixels of a view block (about [of drawing 10 / step S314]) and processing of all pixels will not be completed, decision of the dot formation existence about the following new pixel is started.

[0119] pixel Pa about -- if dot formation existence is judged -- a degree -- pixel Pb about -- decision is started. pixel Pb about -- decision -- pixel Pa about -- it can carry out almost like decision. Drawing 15 (b) is Pixel Pb. It is the explanatory view having shown notionally signs that a surrounding non-judged pixel was made to diffuse the produced gradation error. Pixel Pa Since it is already decision ending about dot formation existence if it attaches, it is Pixel Pb. The produced gradation error is diffused in a total of four pixels of two pixels in a view block, and two pixels outside a view block as illustrated. drawing 16 (b) -- pixel Pb from -- an example of the rate which a gradation error diffuses in a surrounding non-judged pixel is shown.

[0120] pixel Pb about -- if dot formation existence is judged -- the same -- carrying out -- pixel Pc about -- it judges and a surrounding non-judged pixel is made to diffuse the gradation error produced with decision Drawing 15 (c) is Pixel Pc. It is the explanatory view having shown signs that the produced gradation error was diffused, notionally. It is the pixel Pa within a view block as illustrated. And pixel Pb Since it is already decision ending about dot formation existence if it attaches, it is Pixel Pc. The produced gradation error is the pixel Pd within a view block. And it is spread at a predetermined rate in a total of four pixels of three pixels outside a view block. Drawing 16 (c) is Pixel Pc. It is the explanatory view which illustrated the rate which the produced gradation error diffuses in a surrounding pixel. in this way, pixel Pc if predetermined comes out of the produced error comparatively and it is spread in a surrounding non-judged pixel -- pixel Pd about -- decision is started.

[0121] Drawing 15 (d) is Pixel Pd. It is the explanatory view having shown signs that the produced gradation error was diffused, notionally. It is Pixel Pd as illustrated. Since five non-judged pixels exist in the surroundings, these pixels are made to diffuse a gradation error. Drawing 16 (d) is the explanatory view which illustrated the rate of making each pixel diffusing an error.

[0122] In this way, Pixel Pa, Pixel Pb, Pixel Pc, and Pixel Pd It judges whether processing of all the pixels within [after ending the processing about four pixels] a view block was ended (about [of drawing 10 / step S314]), and processing of step S226 of drawing 5 is ended.

[0123] Though it judges per block that dot formation existence explained above by processing of step S226 of drawing 5, dot formation existence is judged diffusing the gradation error produced in each pixel in a surrounding non-judged pixel, and processing equivalent to the so-called error diffusion method is performed. For this reason, even when the view block is set as the field more than the middle gradation in an image, it is possible to judge dot formation existence, with image quality maintained.

[0124] In addition, it faces judging the dot formation existence of each pixel which constitutes a view block from an example shown in drawing 15, and they are Pixel Pa, Pixel Pb, Pixel Pc, and Pixel Pd. Although judged in sequence, as it is not necessary to necessarily judge in this sequence for example, and is shown in drawing 17, they are Pixel Pa, Pixel Pc, Pixel Pb, and Pixel Pd. Dot formation existence may be judged in sequence. The case of drawing 15, and in the case of drawing 17, as long as it compares both drawings, the directions which diffuse an error differ within the block and the sequence that good image quality is acquired may be suitably chosen so that clearly. Moreover, it does not matter as a thing which makes the pixel of the larger range diffuse a gradation error so that it may illustrate to drawing 14.

[0125] Since it means that diffusion of the gradation error produced by the decision and this decision of the dot formation existence about a view block which were set up at step S200 was completed when ending processing of step S226 of drawing 5, or step S224, next, it judges whether the processing about a whole block was ended (step S228). If the unsettled block remains, it will return to step S200 again, a view block will be moved by 1 block, and a series of continuing processings will be performed. In this way, if dot formation existence is judged about a whole block, the number transform processing of gradation will be ended and it will return to image data conversion processing of drawing 4.

[0126] As mentioned above, since the existence of dot formation is judged in the number transform processing of gradation of this example in the block unit which summarized two or more pixels of a predetermined number as explained, the number transform processing of gradation can be performed quickly. Moreover, it faces judging the dot formation existence of a view block, and judges as what kind of field this view block is set in the image based on the gradation value of each pixel within this view block, or the size relation of amendment data, and dot formation existence is judged using a suitable approach. For this reason, image quality is maintainable in spite of judging the existence of dot formation in the block unit, since dot formation existence can be judged by the approach according to a gradation value or amendment data. Furthermore, since dot formation existence is judged using an approach equivalent to the so-called error diffusion method when the field in the image which judges dot formation existence is a field more than middle gradation, a high-definition image can be obtained.

[0127] E. Modification : various modifications exist in the above-mentioned number transform processing of gradation. Hereafter, it explains briefly.

[0128] E-1. The 1st modification : in the above-mentioned number transform processing of

gradation, the gradation value of each pixel from which the total S of a view block constitutes "0", i.e., a view block, judged that neither formed a dot in this block when it is "0" (step S206:yes of drawing 5), and diffused the error produced with this view block in the circumference pixel (step S212 thru/or step S224 of drawing 5).

[0129] On the other hand, when the total S of a view block is continuously set to "0", it is good also considering the value of the diffusion error memorized by matching with each pixel within this block as "0." That is, in step S224 of drawing 5 , processing as shown in drawing 18 may be performed. First, the total S of the gradation value of each pixel which constitutes a view block judges whether it is "0" (step S300), if the value of Total S is not "0", "0" will be set to Flag F (step S302), and a circumference pixel is made to diffuse the gradation error produced with a view block (step S304). The concrete processing performed in step S304 is the same as processing of step S224 mentioned above.

[0130] In step S300, when the total S of a view block is "0", Flag F judges whether it is "1" (step S306). When the total S of the view block judged previously is not "0", in step S302, "0" is set to Flag F. After setting the value "1" which shows that the view block total S is "0" as Flag F (step S308), a circumference pixel is made to diffuse the gradation error produced with a view block in this case (step S306: no) (step S304). When the total S of the view block judged previously is "0", "1" is set to Flag F at step S308. In such a case, (step S306: yes), the value of the diffusion error memorized by each pixel within this view block is initialized to "0" instead of diffusing the gradation error produced with a view block (step S310).

[0131] Since all the gradation values of each pixel which constitutes a view block must be "0" in order for the total S of a view block to be "0", it is thought that that Total S is continuously set to "0" is the part which the image which should be expressed does not exist in the part, namely, should leave a print sheet with a ground color. In the 1st above-mentioned modification, the value of the diffusion error of each pixel is initialized in such a part. For this reason, originally it becomes possible to express a higher-definition image, without forming a dot under the effect of the error diffused from a perimeter into the part in which an image does not exist. Moreover, since the processing which diffuses the gradation error produced with this block in the view block to which Total S is continuously set to "0" is omitted, processing quickly so much is possible.

[0132] E-2. The 2nd modification : in the number transform processing of gradation mentioned above, although the suitable dot formation decision approach is chosen based on Total S or amendment data of a view block, if a suitable approach is chosen based on the gradation value of each pixel which constitutes a view block, it is not necessary to necessarily choose based on the value of total or amendment data. For example, a location with a view block may respond for whether being the part into which the gradation value of being the edge part of an image, i.e., image data, changes suddenly, and may choose the suitable decision approach so that it may explain below.

[0133] Drawing 19 is the flow chart which showed the flow of the processing which judges the existence of dot formation using a suitable approach according to whether an edge part

has a view block in addition to total of a view block, or the value of amendment data. The parts to which the processing (step S408) whose view block judges whether it is an edge location is added differ greatly to the number transform processing of gradation shown in drawing 5 . Hereafter, according to the flow chart of drawing 19 , it explains briefly focusing on a part which is different to processing of drawing 5 about the number transform processing of gradation of the 2nd modification.

[0134] The total S of a view block is computed by setting up a view block first (step S400), and reading the gradation value and diffusion error of a pixel within a block also in the number transform processing of gradation of the 2nd modification, like the number transform processing of gradation mentioned above using drawing 5 , (step S402). Subsequently, it judges whether the computed total S is "0" (step S404), and when Total S is "0", it is judged that a dot is not formed about all the pixels that constitute this view block (step S412). When the total S of a view block is not "0", it is the amendment data Bx. It computes (step s406). Amendment data bX It is computable using (2) types like the number transform processing of gradation mentioned above using drawing 5 .

[0135] Next, the location where the view block is set up judges whether it is an edge part (step S408). It can judge whether an edge part has a view block by comparing the gradation value of the pixels which adjoin within a view block. For example, it is Pixel Pa as shown in drawing 20 (a). It considers as a core and is Pixel Pa. Pixel Pb and pixel Pa Pixel Pc and pixel Pa Pixel Pd If each difference of a gradation value is below a predetermined value, a view block can be judged not to be an edge part. namely, $\neg \text{abs} < (DTa \cdot DTb) \text{) the And } \text{abs} < (DTa \cdot DTc) \text{) the And } \text{abs} < (DTa \cdot DTd) \text{) the } \dots (3)$

It comes out, and if it is, it will be judged that the location where the view block is set up is not an edge part in an image. Here, it is $\text{abs} \cdot (X)$ is a function which calculates the absolute value of X. Moreover, threshold the It is beforehand set as the suitable value. At drawing 20 (a), it is Pixel Pa. They are Pixel Pb, Pixel Pc, and Pixel Pd, respectively. The arrow head currently displayed in between shows that it judges whether it is an edge based on the difference of the gradation value between these pixels.

[0136] You may judge simply as follows whether the location where the view block is set up is an edge part instead of judging by the above-mentioned (3) types. That is, it is Pixel Pa as shown in drawing 20 (b). Pixel Pd The difference of the gradation value of a between, and pixel Pb Pixel Pc In below a predetermined value, each difference of the gradation value of a between may judge that a view block location is not an edge part. Or the difference of the biggest gradation value in the pixel which constitutes a view block, and the smallest gradation value is searched for, and when the difference of this gradation value is larger than a predetermined threshold, you may judge that it is set as an edge part by this view block.

[0137] In this way, when a view block location is judged not to be an edge part (step S408: no), the number transform processing of gradation mentioned above using drawing 5 and same processing are performed. Namely, amendment data Bx of a view block The predetermined threshold th1, th2, and th3 It compares (steps S410, S414, and S418). It is

the amendment data Bx of a view block, respectively. A circumference pixel is made to diffuse the gradation error which judged dot formation existence by the predetermined approach according to the value (steps S412, S416, and S420), and was produced with the whole view block (steps S422 and S424). Moreover, amendment data Bx of a view block A value is a threshold th3. In being large, it judges dot formation existence for every pixel, making a surrounding non-judged pixel diffuse the gradation error produced in each pixel (step S426).

[0138] When it is judged that the view block is located in the edge part in an image (step S408: yes of drawing 19), it is the amendment data Bx. It is not concerned with a value, but dot formation existence is judged for every pixel, making a surrounding non-judged pixel diffuse the error of each pixel (step S426). If it carries out like this, since dot formation existence is surely judged for every pixel, in the part of the edge in an image, the resolution of image data is maintainable. Therefore, without making the profile in an image indistinct, since it becomes possible to perform the number transform processing of gradation quickly, it is suitable.

[0139] As mentioned above, although various kinds of examples have been explained, this invention is not restricted to the example of all above, and can be carried out in various modes in the range which does not deviate from the summary.

[0140] For example, in the example mentioned above, in order to avoid complicated-ization of explanation, it explained to each pixel as what is formed and cannot take only two conditions, or [whether a dot is formed or / that there is nothing]. of course, the printer which can form the dot from which magnitude differs -- or you may apply to the printer which can form two or more kinds of dots from which ink concentration differs. By these printers, since only the part whose class of dot which can be formed increased is in the inclination for the number transform processing of gradation to become complicated, and for the processing time to also become long, the number transform processing of gradation of the various examples mentioned above is suitably applicable.

[0141] Moreover, the software program (application program) which realizes an above-mentioned function may be supplied and performed to the main memory or external storage of a computer system through a communication line. Of course, the software program memorized by CD-ROM and the flexible disk may be read and performed.

[0142] Although the various examples mentioned above explained the image data-conversion processing including the number transform processing of gradation as what is performed within a computer, a part or all of image data-conversion processing may be performed a printer side using the image processing system of dedication.

[0143] Furthermore, an image display device may be a liquid crystal display with which gradation expresses the image which changes continuously by necessarily not being limited to the airline printer which forms an ink dot on print media and prints an image, and distributing the luminescent spot by the suitable consistency on a liquid crystal display screen for example.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the outline block diagram of the printing system in which the gestalt of operation of this invention is shown.

[Drawing 2] It is the explanatory view showing the configuration of the computer as an image processing system of this example.

[Drawing 3] It is the outline block diagram of the printer as an image display device of this example.

[Drawing 4] It is the flow chart which shows the flow of the image data conversion processing performed with the image processing system of this example.

[Drawing 5] It is the flow chart which shows the flow of the number transform processing of gradation of this example.

[Drawing 6] It is the explanatory view showing signs that the view block is set up.

[Drawing 7] It is the explanatory view showing signs that a dot is formed only in 1 pixel in each pixel which constitutes a view block.

[Drawing 8] It is the explanatory view which illustrates signs that a dot is formed only in two pixels in each pixel which constitutes a view block.

[Drawing 9] It is the explanatory view having shown notionally how to judge the existence of the dot formation to every pixel, making each pixel within a view block diffuse an error.

[Drawing 10] It is the flow chart which showed the flow of the processing which judges dot formation existence for every pixel.

[Drawing 11] It is the explanatory view having shown notionally other methods of judging the existence of the dot formation to every pixel, making each pixel within a view block diffuse an error.

[Drawing 12] It is the explanatory view having shown notionally signs that a surrounding pixel was made to diffuse the gradation error produced with a view block.

[Drawing 13] It is the explanatory view having shown notionally the modification which makes a surrounding pixel diffuse the gradation error produced with a view block.

[Drawing 14] It is the explanatory view which illustrates signs that the rate of making a surrounding pixel diffusing the gradation error produced with a view block is set up.

[Drawing 15] It is the explanatory view having shown notionally signs that the existence of dot formation was judged in a block unit, making a circumference pixel diffuse the gradation error produced in each pixel.

[Drawing 16] In case the existence of dot formation is judged in a block unit, making a circumference pixel diffuse the gradation error produced in each pixel, it is the explanatory view which illustrated the rate which diffuses an error to a circumference pixel.

[Drawing 17] It is the explanatory view having shown notionally other modes which judge the existence of dot formation in a block unit, making a circumference pixel diffuse the

gradation error produced in each pixel.

[Drawing 18] It is the flow chart which showed the flow of the processing performed in the 1st [of the number transform processing of gradation of this example] modification.

[Drawing 19] It is the flow chart which showed the flow of the 2nd modification of the number transform processing of gradation of this example.

[Drawing 20] In the 2nd modification of the number transform processing of gradation of this example, it is the explanatory view showing notionally how to detect an edge.

[Description of Notations]

10 -- Computer
12 -- Printer driver
20 -- Color printer
100 -- Computer
102 -- CPU
104 -- ROM
106 -- RAM
108 -- Peripheral-device interface P-I/F
109 -- Disk controller DDC
110 -- Network Interface Card NIC
112 -- Video interface V-I/F
114 -- CRT
116 -- Bus
118 -- Hard disk
120 -- Digital camera
122 -- Color scanner
124 -- Flexible disk
126 -- Compact disk
200 -- Color printer
230 -- Carriage motor
235 -- Paper feed motor
236 -- Platen
240 -- Carriage
241 -- Print head
242,243 -- Ink cartridge
244 -- Head for ink regurgitation
260 -- Control circuit
261 -- CPU
262 -- ROM
263 -- RAM
300 -- Communication line
310 -- Storage